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## THE USE OF VASECTOMIZED MALE MICE AS INDICATORS

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In the course of certain experiments with mice it became necessary to have some way of determining the presence of the ovulation period in females which were still virgins. The small size of the external genitalia and the minuteness of the changes in them at periods of ovulation make methods of direct observation difficult if not impossible.

It was found convenient therefore, to use vasectomized males to indicate the physiological condition of the females. For this purpose, males sexually mature or nearly so, were etherized and an incision about 6 mm. long was made, a little to the right of the mid-ventral line in the right inguinal region, the hair having been previously clipped in that locality. Care was taken to avoid the larger blood vessels in the peritoneum. Through this opening it was possible with a pair of small serrated forceps, to lift out first the right and then the left testicle and their respective vasa deferentia. A piece of the vasa deferentia, about 3 mm. in length, was tied off with fine black silk, and the section between the ligatures removed. The testicles and vasa deferentia were then replaced in the peritoneal cavity and the body wall and the outer skin sewed separately. Warm salt solution was used when necessary to keep the exposed organs moist.

In a great majority of cases the operation was entirely successful and the mice recovered rapidly. In two weeks these mice were placed with females known to have had young between twenty-four and thirty-six hours previous. The vasectomized males behaved like normal males as regards their sexual instincts, and attempted successfully to copulate with the females. In so far as it was possible to observe, there was no difference in the process of mating between vasectomized and normal males.

A breeding test on a larger scale was made to determine whether in a considerable period of time the vasectomized males would be able to fertilize an occasional female. For this purpose virgin females, just becoming sexually mature, were placed with vasectomized males and were controlled by an equal number of similar females placed with normal males. The first twenty males, both vasectomized and normal, were allowed to remain with females for only ten days. During this time in a total of 106 females, the pens containing vasectomized males

had a record of no observed pregnancies, while the controls showed seven pregnancies in a total of 98 females. The second series of results showed a more definite difference. In eleven pens in which vasectomized males were allowed to remain for from eighteen to twenty days, with a total of 60 females, there were no pregnancies; while control males remaining in pens containing 55 females for from eighteen to twenty days gave a total of nineteen pregnancies. The chief reason for lengthening the time during which the females and males were together was the appearance of a communication by Long concerning the period of ovulation in mice, which states that the average length of time between the first and second ovulations following parturition in mice is from seventeen to eighteen days. It became evident therefore, that the first series of experiments in which female mice were allowed to remain with the males only ten days, would not be critical, in as much as the space between ovulation periods in virgin mice is undoubtedly approximately the same as the length of time between the first and second ovulations following parturition; and therefore probably only about one-half of the females would pass through an ovulation period while with the males. The longer period gives a far better test as the results show.

Before the experiments here recorded were made, a number of males were operated on and in each case a portion of the vasa deferentia 3 mm. long was removed. The cut ends, however, were not ligatured. Thirty-nine of these males were chloroformed, slightly over two months after operation, and were examined to see whether any possible connection between the severed vasa deferentia had been reestablished. In no case was there any sign of such a connection. In many cases there was obvious blockage and distention of the vasa deferentia, apparently by retention of substances which would have ordinarily passed through them. Certain signs of inflammation and reduction in the size of the testicles were also frequently observed. It would be interesting to see whether the sexual instincts of vasectomized males remained normal after the degenerative changes of the testes and vasa deferentia referred to had set in.

By supplementing observations on the sexual instincts of these males with a careful histological examination of the testes it might be possible to obtain an additional line of evidence as to whether it was primarily the interstitial or the sperm forming cells which influence the secondary sexual characters.

By the use of vasectomized males it will be possible to pick out the females which are in a suitable physiological condition for successful

insemination by artificial or natural means, thereby minimizing the amount of error introduced in experimental work by the use of females in unknown physiological condition. In critical experiments by using for an indicator a vasectomized male, homozygous for one color factor, and for the later insemination sperm from a male homozygous for another color factor, one will have a definite breeding test showing whether or not, by any accident, the vasectomized male was able to transfer sperm to the female.

## PHOTOGRAPHIC MAGNITUDES OF STARS IN THE SELECTED •AREAS OF KAPTEYN

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Communicated by G. E. Hale, February 1, 1917

A casual experience with the details of astronomical investigation reveals, in the number of the stars, a serious difficulty to be overcome in undertaking any discussion of the development and structure of the stellar universe. Telescopes of even moderate size bring before the observer stars to be counted by tens of millions, while those shown by instruments of the highest power are many times more numerous. Since the individual examination of all these objects will not be seriously considered, the question arises as to a rational limitation of the program of observations. Fortunately, the problem is not as hopeless as it seems, for very important and illuminating facts are to be derived from a minute percentage of the total number of stars seen in our telescopes, provided only that the objects chosen for study be representative of the collection as a whole.

Kapteyn, in 1906, showed that by proper restriction and selection we might hope to obtain, within a comparatively few years, a fairly comprehensive notion of the salient features of the structure of the universe. His well-known 'Plan of Selected Areas,' published in that year,<sup>1</sup> formulates in a definite way the investigations to be undertaken in order that we may acquire an adequate knowledge of stellar positions, distances, proper motions, radial velocities, spectra, and magnitudes, both visual and photographic, which are the data essential for a consideration of the questions of structure and development.

The principle of selection adopted by him involves the detailed examination of all objects within the reach of observation, situated in certain small areas uniformly distributed over the sky. About two hundred such selected areas are included in the list; the center in each case